

WHAT IS CLAIMED IS:

1        1. A method for correlating a received sequence to  
2        known sequences in a communications system, comprising the  
3        steps of:  
4                providing a plurality of known sequences of values;  
5                receiving a sequence of values;  
6                producing at least one reusable addend;  
7                applying said sequence of values to each known  
8        sequence of values of said plurality of known sequences of  
9        values to produce respective sets of addends, each set of  
10      addends of said respective sets of addends corresponding to  
11      a respective known sequence of values of said plurality of  
12      known sequences of values and including said at least one  
13      reusable addend;  
14                determining respective correlation results  
15        responsive to said respective sets of addends, each  
16        respective correlation result corresponding to a correlation  
17        between said sequence of values and a respective known

18 sequence of values of said plurality of known sequences of  
19 values; and

20 wherein said each set of addends of said respective  
21 sets of addends have been reduced in number utilizing a  
22 common subexpression elimination algorithm.

1 2. The method of Claim 1, wherein said each known  
2 sequence of values of said plurality of known sequences of  
3 values includes a plurality of +1 values and a plurality of  
4 -1 values.

1 3. The method of Claim 1, wherein said step of  
2 producing at least one reusable addend comprises the step of  
3 producing said at least one reusable addend responsive to  
4 said sequence of values.

1 4. The method of Claim 1, wherein said each known  
2 sequence of values of said plurality of known sequences of  
3 values comprises a training sequence.

1       5. The method of Claim 1, wherein said communications  
2 system comprises a wireless communications system operating  
3 substantially in accordance with the Global System for Mobile  
4 Communications (GSM) standard.

1       6. The method of Claim 1, wherein said step of  
2 applying said sequence of values to each known sequence of  
3 values of said plurality of known sequences of values to  
4 produce respective sets of addends comprises the step of  
5 applying said sequence of values to said each known sequence  
6 of values of said plurality of known sequences of values in  
7 a plurality of manipulated correlation equations.

1       7. The method of Claim 1, further comprising the steps  
2 of:

3               determining whether said each respective  
4 correlation result meets a predetermined criterion; and  
5               if so, initiating at least one algorithm for  
6 detecting and rejecting a signal associated with said each  
7 respective correlation result.

1       8. The method of Claim 1, wherein said step of  
2 applying said sequence of values to each known sequence of  
3 values of said plurality of known sequences of values to  
4 produce respective sets of addends comprises the step of  
5 applying said sequence of values at a plurality of offsets  
6 to said each known sequence of values of said plurality of  
7 known sequences of values.

1        9. A method for correlating a received sequence to a  
2        known sequence in a communications system, comprising the  
3        steps of:

4                receiving a sequence of values;

5                applying said sequence of values to at least one  
6        known sequence of values in a correlation equation, said  
7        correlation equation definable as including a sum of products  
8        of said sequence of values and said at least one known  
9        sequence of values;

10                determining a correlation result of said  
11        correlation equation using a sum that is independent of said  
12        at least one known sequence of values; and

13                wherein said correlation equation has been  
14        manipulated to produce said sum that is independent of said  
15        at least one known sequence of values.

1        10. The method of Claim 9, wherein said sum that is  
2        independent of said at least one known sequence of values is  
3        dependent on said sequence of values and offsets thereof.

1        11. The method of Claim 9, further comprising the step  
2        of updating said sum that is independent of said at least one  
3        known sequence of values when an offset is being incremented  
4        or decremented using no more than two values of said sequence  
5        of values.

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1           12. A method for correlating a received sequence to a  
2       known sequence in a communications system, comprising the  
3       steps of:

4               receiving a sequence of values;

5               applying said sequence of values to at least one  
6       known sequence of values in a correlation equation, said  
7       correlation equation definable as including a sum of products  
8       of said sequence of values and said at least one known  
9       sequence of values, said at least one known sequence of  
10      values including a known number of values and at least two  
11      identical subsequences of values;

12              determining a correlation result of said  
13       correlation equation using a sum of products whose number of  
14       product addends is less than said known number of said known  
15       number of values; and

16              wherein said correlation equation has been  
17       manipulated such that said number of product addends of said  
18       sum of products is less than said known number of said known  
19       number of values by eliminating products of one of said at  
20       least two identical subsequences of values.

1        13. The method of Claim 12, wherein said number of  
2        product addends of said sum of products is less than said  
3        known number of said known number of values by a number equal  
4        to a length of each of said at least two identical  
5        subsequences of values.

1        14. The method of Claim 12, wherein at least one  
2        product addend of said number of product addends comprises  
3        a multiplication by 1 that requires no mathematical  
4        operation.

1        15. A method for correlating a received sequence to  
2        known sequences in a communications system, comprising the  
3        steps of:

4                providing a first known sequence of values;  
5                providing a second known sequence of values;  
6                receiving a sequence of values;  
7                producing a common addend responsive to said  
8        sequence of values;  
9                applying said sequence of values to said first  
10      known sequence of values at a plurality of offsets to produce  
11      a first set of addends, said first set of addends including  
12      said common addend;  
13                applying said sequence of values to said second  
14      known sequence of values at said plurality of offsets to  
15      produce a second set of addends, said second set of addends  
16      including said common addend;  
17                calculating a first correlate based, at least in  
18      part, on said first set of addends;  
19                calculating a second correlate based, at least in  
20      part, on said second set of addends; and

21           wherein said first set of addends and said second  
22   set of addends are determined, at least partially, by a  
23  common subexpression elimination analysis.

1           16. The method of Claim 15, wherein said step of  
2  producing a common addend responsive to said sequence of  
3  values further comprises the step of adjusting said common  
4  addend responsive to an offset value of said plurality of  
5  offsets.

1           17. The method of Claim 16, wherein said step of  
2  adjusting said common addend responsive to an offset value  
3  of said plurality of offsets further comprises the step of  
4  adjusting said common addend by performing only two add or  
5  subtract operations when incrementing from a first offset of  
6  said plurality of offsets to a second offset of said  
7  plurality of offsets.

1        18. The method of Claim 15, wherein said common addend  
2        is independent of both said first known sequence of values  
3        and said second known sequence of values.

1        19. The method of Claim 15, wherein said step of  
2        calculating a first correlate based, at least in part, on  
3        said first set of addends comprises the step of calculating  
4        a negative of said first correlate if a number of non-zero  
5        first-order terms involved in said step of calculating a  
6        first correlate based, at least in part, on said first set  
7        of addends meets a predetermined criterion.

1           20. The method of Claim 15, further comprising the  
2 steps of:

3           creating a plurality of second order terms by  
4 combining a respective plurality of at least two values of  
5 said sequence of values;

6           adjusting "less than all second order terms of said  
7 plurality of second order terms when incrementing from a  
8 first offset of said plurality of offsets to a second offset  
9 of said plurality of offsets; and

10           wherein said step of calculating a first correlate  
11 based, at least in part, on said first set of addends  
12 comprises the step of calculating said first correlate based,  
13 at least in part, on said plurality of second order terms.

1        21. A method for correlating a received sequence to a  
2        known sequence in a communications system, comprising the  
3        steps of:

4                receiving a sequence of values;

5                applying said sequence of values to at least one  
6        known sequence of values in a correlation equation, said  
7        correlation equation definable as including a sum of products  
8        of said sequence of values and said at least one known  
9        sequence of values; and

10                determining a correlation result of a manipulated  
11        version of said correlation equation, said manipulated  
12        version of said correlation equation derived from performing  
13        at least two of the following modifications:

14                said correlation equation modified so that at  
15        least one product of said sum of products of said  
16        correlation equation becomes zero;

17                said correlation equation modified to produce  
18        a sum that is independent of said at least one known  
19        sequence of values;

20                   said correlation equation, wherein said at  
21                   least one known sequence of values includes a known  
22                   number of values and at least two identical  
23                   subsequences of values, modified such that a number of  
24                   product addends of said sum of products of said  
25                   correlation equation is less than said known number of  
26                   said known number of values of said at least one known  
27                   sequence of values by eliminating products  
28                   corresponding to one of said at least two identical  
29                   subsequences of values of said at least one known  
30                   sequence of values;

31                   said correlation equation and terms thereof  
32                   modified so as to eliminate common subexpressions; and  
33                   said correlation equation modified such that  
34                   a negative result of said correlation equation is to be  
35                   calculated.

1        22. The method of Claim 21, further comprising the  
2 steps of:

3                determining whether said correlation result meets  
4 a predetermined criterion; and

5                if so, initiating at least one algorithm for  
6 detecting and rejecting a signal that corresponds to said  
7 correlation result that meets said predetermined criterion.

1        23. The method of Claim 21, wherein said communications  
2 system comprises a wireless communications system operating  
3 substantially in accordance with the Global System for Mobile  
4 Communications (GSM) standard.

1        24. The method of Claim 21, wherein:

2                said step of applying said sequence of values to  
3 at least one known sequence of values in a correlation  
4 equation comprises the step of applying said sequence of  
5 values at a plurality of offsets to said at least one known  
6 sequence of values in said correlation equation.

1        25. A communication station for correlating a received  
2        sequence to a known sequence in a communications system, the  
3        communication station comprising:

4                a receiver, said receiver adapted to receive a  
5        sequence of values;

6                a processing unit operatively connected to said  
7        receiver, said processing unit adapted to apply said sequence  
8        of values to at least one known sequence of values in a  
9        correlation equation, said correlation equation definable as  
10      including a sum of products of said sequence of values and  
11      said at least one known sequence of values;

12                said processing unit operable to determine a  
13      correlation result of a manipulated version of said  
14      correlation equation, said manipulated version of said  
15      correlation equation derived as a result of performing at  
16      least two of the following modifications:

17                modify said correlation equation so that at  
18      least one product of said sum of products of said  
19      correlation equation becomes zero;

20 modify said correlation equation to produce  
21 a sum that is independent of said at least one known  
22 sequence of values;  
23 modify said correlation equation, wherein  
24 said at least one known sequence of values includes a  
25 known number of values and at least two identical  
26 subsequences of values, such that a number of product  
27 addends of said sum of products is less than said known  
28 number of said known number of values by eliminating  
29 products corresponding to one of said at least two  
30 identical subsequences of values;  
31 modify said correlation equation and terms  
32 thereof so as to eliminate common subexpressions; and  
33 modify said correlation equation such that a  
34 negative result of said correlation equation is to be  
35 calculated.

1        26. The communication station of Claim 25, wherein said  
2        processing unit is further operable to determine whether said  
3        correlation result meets a predetermined criterion; and  
4                wherein the communication station further comprises  
5        means for initiating at least one algorithm for detecting and  
6        rejecting a signal that corresponds to said correlation  
7        result that meets said predetermined criterion.

1        27. The communication station of Claim 25, wherein said  
2        communications system comprises a wireless communications  
3        system operating substantially in accordance with the Global  
4        System for Mobile Communications (GSM) standard.

1        28. The communication station of Claim 25, further  
2        comprising a memory unit operatively connected to said  
3        processing unit, said memory unit storing a plurality of  
4        known sequences of values.

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1        29. The communication station of Claim 25, wherein the  
2 communication station comprises a mobile terminal or a base  
3 station.

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1       30. A communication station for correlating a received  
2 sequence to a known sequence in a communications system, the  
3 communication station comprising:

4               a receiver, said receiver adapted to receive a  
5 sequence of values;

6               a memory, said memory storing a plurality of known  
7 sequences of values;

8               a processing unit operatively connected to said  
9 receiver and said memory, said processing unit programmed to  
10 compute a plurality of correlation results between said  
11 sequence of values and said plurality of known sequences of  
12 values; and

13               wherein said processing unit is configured to  
14 compute said plurality of correlation results using a  
15 modified correlation equation.

1        31. The communication station of Claim 30, wherein said  
2        modified correlation equation comprises a correlation  
3        equation that has been modified, said correlation equation  
4        definable as including a sum of products of said sequence of  
5        values and a known sequence of values from said plurality of  
6        known sequences of values, the modification resulting from  
7        performing at least two of the following operations:

8                modify said correlation equation so that at  
9                least one product of said sum of products of said  
10               correlation equation becomes zero;

11               modify said correlation equation to produce  
12               a sum that is independent of said known sequence of  
13               values;

14               modify said correlation equation, wherein  
15               said known sequence of values includes a known number  
16               of values and at least two identical subsequences of  
17               values, such that a number of product addends of said  
18               sum of products is less than said known number of said  
19               known number of values by eliminating products

20       corresponding to one of said at least two identical  
21       subsequences of values;

22               modify said correlation equation and terms  
23       thereof so as to eliminate common subexpressions; and

24               modify said correlation equation such that a  
25       negative result of said correlation equation is to be  
26       calculated.

1       32. The communication station of Claim 31, wherein said  
2       operations are completed prior to receiving said sequence of  
3       values and during a design or initialization phase of the  
4       communication station.

1       33. The communication station of Claim 30, wherein the  
2       communication station comprises at least one of base station  
3       and a mobile terminal.

1        34. The communication station of Claim 30, wherein said  
2        processing unit is further programmed to initiate at least  
3        one algorithm for detecting and rejecting any signal  
4        corresponding to a correlation result of said plurality of  
5        correlation results that is greater than a predetermined  
6        threshold.

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